

REMARKS

No claims are added, amended or canceled; as a result, claims 1, 2, and 4-45 remain pending in this application.

The Office action held:

With respect to Applicant's arguments on pages 15-17 of the Remarks that Verhaverbeke's acetic acid only serves as catalyst (Verhaverbeke, col. 4, line 34) and not as a surface tension lowing agent or as an etch initiator, it is pointed out that there is no proof that Verhaverbeke's acetic acid only serves as catalyst.

Applicant disagrees with the Office action's characterization of Applicant's prior response. Pages 15-17 of Applicant's response filed on January 25, 2006 recites the Examiner's obligation as provided in the M.P.E.P., and further points out specific instances where the Examiner's burden of *prima facie* obvious has not been met. Applicant did not point out "that there is no proof that Verhaverbeke's acetic acid only serves as catalyst." There is, however, no indication in the Verhaverbeke disclosure that acetic acid serves any purpose but what Verhaverbeke has labeled a catalyst.

The Office action further held:

In the same column, column 4, beginning on line 10, Verhaverbeke discloses that "[A]nhydrous HF hardly etches silicon oxide at room temperature. A catalyst is necessary to start the reaction", effectively teaching that the catalyst, which is an alcohol, a methanol, an acetic acid, and specially carboxylic . . .

Applicant disagrees with the above characterization of the Verhaverbeke et al disclosure. First, the clear language of Verhaverbeke indicates only that H₂O and acetic acid function as a catalyst for anhydrous HF for silicon oxide. (see "A catalysis is needed to start the reaction. Although H₂O can fulfill this role . . ." col. 4, lns. 10-12). This statement is followed by the statement that "[t]he acetic acid only serves as catalysts (col. 4, ln. 34). Verhaverbeke et al restate this using the language "Acetic acid appears to have a similar catalytic effect on the HF etch process as H₂O because substantial etch rates are achieved." (see col. 5, lns. 4-6). Nowhere

else in the Verhaverbeke disclosure but these three instances is a catalyst mentioned. And nowhere in Verhaverbeke et al is Applicant able to find any teaching of an alcohol or a methanol serving as a catalyst.

The Office further held:

"A catalyst is necessary to start the reaction", effectively teaching that the catalyst . . . is an element of the vapor phase etchant, meeting the claimed limitation "a vapor including an agent" (see definition of "include" . . . (emphasis original)

Applicant disagrees with the characterization of Verhaverbeke and the mischaracterization of Applicant's claimed inventions. First, none of Applicant's claims include the language "a vapor including an agent". Second, none of Applicant's claims include the language "catalyst". Applicant declines to accept the Examiner's definition of element, and further declines to accept the assertion that catalyst and etch initiator are equivalent. A catalyst is something that changes the rate of a chemical reaction without itself being net consumed in the reaction. A catalyst operates by lowering the activation energy of the reaction. On the other hand, an etch initiator has no such limitations.

The Office further held:

[S]ince the disclosed material, an alcohol, a methanol, an acetic acid, and specially carboxylic, is the same as the claimed material (for example, claims 2 and 8), the disclosed agent, an alcohol, a methanol, an acetic acid, and specially carboxylic, *could* function as a surface tension lowering agent and *could* be termed a surface tension lowering agent as claimed. (emphasis added)

Applicant disagrees with the characterization. First, because the Office action is attempting to define a catalyst, in addition to being an etch initiator, which Applicant refuses to accept, as further being equivalent to a surface tension lowering agent. The only instance of "surface tension" in Verhaverbeke et al is disclosed in the background where Verhaverbeke expressly recognize "in the gas phase the etching of small features is facilitated while surface tension effects hamper this in the liquid phase" (col. 1, lns. 65-67). Nowhere in Verhaverbeke et al do they suggest a solution to the problem of surface tension, and nowhere is there any

suggestion of a “surface tension lowering agent”. In fact, if anything, Verhaverbeke et al appear to teach away from Applicant’s claimed inventions given the language pertaining to alcohols stating,

The acetic acid only serves as catalyst. The etching of SiO₂ by HF generates water on the wafer surface. This water is, together with the acetic acid and the HF . . . must be transported away from the wafer surface by evaporation . . . For other organic liquids like alcohols, acetone . . . the water is not easily removed from the surface, giving rise to a strong increase in surface water concentration in the course of the etching process. This results in a fundamental controllability problem of the etching process which is not present with carboxylic acids and especially acetic acid.
(col. 4, lns. 34-61) (emphasis added)

Where in fact, Verhaverbeke et al expressly disclose that acetic acid and carboxylic acids, in general, are catalysts and that alcohol presents a fundamental problem to surface etching of SiO₂, the Office action incorrectly asserts “surface tension agent” (such as an alcohol) and catalyst are equivalent. A surface tension lowering agent may be something that reduces the cohesive forces of molecules between a substance and a surface. With respect to a surface tension lowering agent, the rate of a chemical reaction is generally not relevant, nor is Applicant aware of any requirement that the reaction rate change as a consequence. Further in fact, as outlined above, Verhaverbeke et al disclose an alcohol that appears to function opposite a surface tension lower agent, or at the very least is not desirable. Second, none of Applicant’s claims include acetone, so this component is moot.

The Office action’s stated that “the disclosed agent, an alcohol, a methanol, an acetic acid, and specially carboxylic *could* function as a surface tension lowering agent and *could* be termed a surface tension lowering agent” is not unsupported anywhere in the language of Verhaverbeke (emphasis added). As such, the Office action assertion appears to be a conclusory statement of a subjective belief. Applicant respectfully traverses the assertion and requests the Examiner provide a reference that describes this assertion. Absent a reference, it appears that the Examiner is using personal knowledge, so the Examiner is respectfully requested to submit an affidavit as required by 37 C.F.R. § 1.104(d)(2).

The Office action further held,

Furthermore, Verhaverbeke discloses in "Example", col. 5, last paragraph, a reaction chamber equipped with three inlets, one for HF, another for acetic acid. Comparing this setup with the present invention (present invention, Fig. 1), one can hardly see a substantial difference, as far as HF source and surface tension lowering agent (acetic acid) are concerned.

The above conclusory statement appears to be based entirely on a personal and subjective belief not founded in any of the art cited. More particularly, the Office action here appears to suggest that use of a surface tension lowering agent and a catalyst are equivalent in everyway. Applicant respectfully traverses the assertion and requests the Examiner provide a reference that describes this element. Absent a reference, it appears that the Examiner is using personal knowledge, so the Examiner is respectfully requested to submit an affidavit as required by 37 C.F.R. § 1.104(d)(2).

The Office action further held,

Furthermore, by Applicant's own admission, the surface tension lowering agent (an alcohol, a methanol, an acetic acid, and specially carboxylic) is approximately 10% of the mixed vapor, approximately 30% of the mixed vapor, or may be a greater or lesser percentage of the mixed vapor (present invention, page 10, lines 19-26). As such, Verhaverbeke's additive element or agent, an alcohol, a methanol, an acetic acid, and specially carboxylic, is fairly termed a surface tension lowering agent.

Applicant respectfully disagrees with the above statement as erroneous. Verhaverbeke et al do not disclose "an alcohol, a methanol, an acetic acid, and specially carboxylic", as a surface tension lowering agent, but rather, as a catalyst. In so holding the Office action is assigning functionality not disclosed by Verhaverbeke and appears to be equating chemical labels with function and use. Applicant, therfore requests the Examiner provide a reference that describes this element. Absent a reference, it appears that the Examiner is using personal knowledge, so the Examiner is respectfully requested to submit an affidavit as required by 37 C.F.R. § 1.104(d)(2).

§103 Rejection of the Claims

Claims 1-2 and 4-37 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Shin et al. (U.S. 6,385,020) in view of Verhaverbeke et al. (U.S. 5,922,624).

Claims 38-45 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Shin et al. in view of Yang et al. (U.S. 6,727,155). Applicant respectfully traverses the rejection.

The Examiner has the burden under 35 U.S.C. 103 to establish a *prima facie* case of obviousness. *In re Fine*, 837 F.2d 1071, 1074, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). As part of establishing a *prima facie* case of obviousness, the Examiner must show that some objective teaching in the prior art or some knowledge generally available to one of ordinary skill in the art would lead an individual to combine the relevant teaching of the references. *Id.*

The court in *Fine* stated that:

Obviousness is tested by "what the combined teaching of the references would have suggested to those of ordinary skill in the art." *In re Keller*, 642 F.2d 413, 425, 208 USPQ 871, 878 (CCPA 1981)). But it "cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching or suggestion supporting the combination." *ACS Hosp. Sys.*, 732 F.2d at 1577, 221 USPQ at 933. And "teachings of references can be combined *only* if there is some suggestion or incentive to do so." *Id.* (emphasis in original).

The M.P.E.P. adopts this line of reasoning, stating that:

"In order for the Examiner to establish a *prima facie* case of obviousness, three base criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on Appellant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed.Cir. 1991))". M.P.E.P. 2142.

All Claim Limitations are not found in the References, whether Alone or in Combination1. *Regarding Claims 1-2, and 4-37:*

Each and every one of Applicant's claims include either a surface tension lowering agent or a surface tension reducing agent feature. The Office action has admitted Shin et al do not teach vapor phase etching, and in particular an agent affecting surface tension, but rather, relies on Verhaverbeke et al in combination with Shin et al. Applicant agrees that Shin et al do not teach vapor phase etching or a surface tension lowering agent. Verhaverbeke et al also do not teach surface tension lowering agent, and therefore, whether alone or in combination, all elements of Applicant's claims are not found in Verhaverbeke et al and Shin et al. For at least this reason, Applicant request withdrawal of the rejection.

a. *With Respect to Claims 1-2, 4-16, 18-21, and 23-37:*

The Office action held:

[T]he '020 reference discloses in Figs. 16A-16B and respective portions of the specification a memory device and an inherent method of fabricating thereof comprising providing a semiconductor substrate . . . that includes a memory container . . . having a double-sided capacitor . . . , which is functionally the same as the memory container having a double-sided capacitor of claim 1, functionally the same as the double-sided capacitor container of claims 7, 11, and 16, functionally the same as the memory container with a sidewall with an embedded capacitor of claim 21, functionally the same as the memory container whose side wall includes a double-sided capacitor of claim 26, and functionally the same as the double-sided container on a semiconductor substrate of claim 31. (emphasis added)

Applicant respectfully disagrees because the Office action does not state a basis for concluding functional equivalency for any element, but rather, appears to be merely stating a subjective belief. Applicant, therefore, requests a reference that describes such features. Absent a reference, it appears that the Examiner is using personal knowledge, so the Examiner is respectfully requested to submit an affidavit as required by 37 C.F.R. § 1.104(d)(2). Applicant further disagrees because the Office action has not established a *prima facie* case of inherency.

In relying upon the theory of inherency, the examiner must provide basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art. (citing Ex parte Levy, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990) (emphasis in original). *MPEP* § 2112

To serve as an anticipation when a reference is silent about the asserted inherent characteristic, the gap in the reference may be filled with recourse to extrinsic evidence. But, such evidence must make clear that “the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill.” *Continental Can Co. v. Monsanto Co.*, 20 USPQ2d 1746, 1749 (Fed. Cir. 1991). Applicant respectfully submits that the Examiner has not produced extrinsic evidence to show that the relevant method is necessarily present in Shin et al.

The Office action held,

Verhaverbeke, in disclosing a method for semiconductor processing, teaches that a vapor phase etching including a vapor that includes hydrogen fluoride (HF), an alcohol, a methanol, and specially carboxylic - that could function as a surface tension lowering agent or as an etch initiator as claimed . . . (emphasis added)

Applicant respectfully disagrees. For sake of brevity, Applicant incorporates the arguments outlined above pertaining to catalyst and surface tension lowering agent. Applicant also reasserts his response filed on January 25, 2006 because the Office action has not responded to Applicant's request for the necessary references showing the believed inherency and a motivation to combine. Applicant therefore request withdrawal of the rejection.

i. *With Respect to Claim 1, 16 and 21:*

Applicant's claims 1, 16, and 21 each recite, in part, “a vapor including a surface tension lowering agent.” Applicant is unable to find any such teaching in the Verhaverbeke disclosure. Since neither Shin et al nor Verhaverbeke et al teach a surface tension lowering agent, either alone or in combination, Applicant's claims 1, 16, and 21 are distinct from and non-obvious with respect to the applied references.

ii. *With Respect to Claims 2, 4-6, 17-20, and 22-25:*

Claims 2, and 4-6 are dependent on claim 1 and incorporates all its elements, claims 17-20 are dependent on claim 16 and incorporate all its elements, and claims 22-25 are dependent on claim 21 and incorporate all its element. Therefore, Applicant's claims 2, 4-6, 17-20, and 22-25 are distinct from and non-obvious with respect to Shin et al and Verhaverbeke et al for at least the reasons stated above.

iii. *With Respect to Claim 7:*

Applicant's claim 7 recites, in part, "vapor comprising vapor for reducing surface tension." Applicant is unable to find any such teaching in the Verhaverbeke disclosure. Since neither Shin et al nor Verhaverbeke et al teach vapor for reducing surface tension, either or alone or in combination, Applicant's claim 7 is distinct from and non-obvious with respect to the applied references.

iv. *With Respect to Claims 8-10:*

Claims 8-10 are dependent on claim 7 and incorporates all its elements. Therefore, Applicant's claims 8-10 are distinct from and non-obvious with respect to Shin et al and Verhaverbeke et al for at least the reason stated above.

v. *With Respect to Claim 11:*

Applicant's claim 11 recites, in part, "a surface tension lowing composition." Applicant is unable to find any such teaching in the Verhaverbeke disclosure. Since neither Shin et al nor Verhaverbeke et al teach a surface tension lowing composition, either or alone or in combination, Applicant's claim 11 is distinct from and non-obvious with respect to the applied references.

vi. *With Respect to Claims 12-15:*

Claims 12-15 are dependent on claim 11 and incorporates all its elements. Therefore, Applicant's claims 12-15 are distinct from and non-obvious with respect to Shin et al and Verhaverbeke et al for at least the reason stated above.

vii. *With Respect to Claim 26:*

Applicant's claim 26 recites, in part, "surface tension reducing composition." Applicant is unable to find any such teaching in the Verhaverbeke disclosure. Since neither Shin et al nor Verhaverbeke et al teach a surface tension reducing composition, either or alone or in combination, Applicant's claim 26 is distinct from and non-obvious with respect to the applied references.

viii. *With Respect to Claims 27-30:*

Claims 27-30 are dependent on claim 26 and incorporates all its elements. Therefore, Applicant's claims 27-30 are distinct from and non-obvious with respect to Shin et al and Verhaverbeke et al for at least the reason stated above.

ix. *With Respect to Claim 31:*

Applicant's claim 31 recites, in part, "a surface tension lowing agent." Applicant is unable to find any such teaching in the Verhaverbeke disclosure. Since neither Shin et al nor Verhaverbeke et al teach a surface tension lowing agent, either or alone or in combination, Applicant's claim 31 is distinct from and non-obvious with respect to the applied references.

x. *With Respect to Claims 32-37:*

Claims 32-37 are dependent on claim 31 and incorporates all its elements. Therefore, Applicant's claims 32-37 are distinct from and non-obvious with respect to Shin et al and Verhaverbeke et al for at least the reason stated above.

2. *Regarding Claims 38-45:*

The Office action has admitted Shin et al do not teach vapor phase etching, and in particular an agent for lowering surface tension, but rather, relies on Yang et al et al in combination with Shin et al. Applicant agrees that the Shin disclosure does not teach vapor phase etching or a surface tension lowering agent. Moreover, Yang et al et al also do not teach a surface tension lowering agent, and therefore, whether alone or in combination, all elements of

Applicant's claims 38-45 are not found in Yang et al and Shin et al. For at least this reason, Applicant request withdrawal of the rejection.

a. With Respect to Claims 38:

Applicant's claim 38 recites, in part, "a vapor including a surface tension lowering agent." Applicant is unable to find any such teaching in the Yang disclosure. Since neither Shin et al nor Yang et al teach a surface tension lowering agent, either or alone or in combination, Applicant's claim 38 is distinct from and non-obvious with respect to the applied references.

b. With Respect to Claims 39-40:

Claims 39-40 are dependent on claim 38 and incorporates all its elements. Since Verhaverbeke et al does not teach a surface tension lowering agent, Applicant's claims 39-40, are therefore distinct from and non-obvious with respect to Shin et al, Yang et al and Verhaverbeke et al for at least the reason stated above.

c. With Respect to Claim 41:

Applicant's claim 41 recites, in part, "a surface tension lowering agent." Applicant is unable to find any such teaching in the Yang disclosure. Since neither Shin et al nor Yang et al teach a surface tension lowering agent, either or alone or in combination, Applicant's claim 41 is distinct from and non-obvious with respect to the applied references.

d. With Respect to Claims 42-45:

Claims 42-45 are dependent on claim 41 and incorporates all its elements. Since Verhaverbeke et al does not teach a surface tension lowering agent, Applicant's claims 42-45 are therefore distinct from and non-obvious with respect to Shin et al Yang et al and Verhaverbeke et al for at least the reason stated above.

Applicant notes Thakur et al. (U.S. 6,251,720) it is no longer being applied and presumes the reference has been withdrawn. Based at least on the above, Applicant requests withdrawal of all rejections and allowance of all claims.

RESPONSE UNDER 37 CFR § 1.116 – EXPEDITED PROCEDURE

Serial Number: 10/789,800

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Title: SEMICONDUCTOR FABRICATION THAT INCLUDES SURFACE TENSION CONTROL

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Dkt: 303.871US1

CONCLUSION

Applicant respectfully submits that the claims are in condition for allowance and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's attorney (612) 349-9587 to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

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CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being filed using the USPTO's electronic filing system EFS-Web, and is addressed to: Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on this 19 day of May, 2006.

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Name

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